AFTER

Application of a Cheeck-All-That-Apply Question to the Characterization of Hibiscus sabdariffa L. drinks with African origin

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UNDERSTANDING how consumers perceive food products is critical for product development. Preference mapping techniques correlate consumer preference ratings to perceived sensory characteristics of the product in order to determine how the sensory characteristics of the product affect consumer liking. However, there are several limitations being that it assumes that consumers and trained assessors perceive the products in the same way. Also, information about how they perceive the sensory characteristics of the product is not gathered. To overcome some of these restrictions, the use of check-all-that-apply questions (CATA) was evaluated. CATA questions consist of a list of words or phrases from which respondents select all the words they consider appropriate to describe a product. This can result in a simpler and more valid approach to gathering information about consumers' perception that includes both their sensory and hedonic impression. CATA questions provide a methodology to obtain a sensory map based only on consumer perception of the products and to perform external preference mapping when a trained sensory panel is not available.The aim of the present work was to apply CATA questions to study consumer perception to *Hibiscus sabdariffa* L. drinks, and to compare results with those achieved using a trained assessors' panel.

Références

Gruenwald J. Novel botanical ingredients for beverages. Clinics in Dermatology 2009, 27, 210-216.

Chadare F. J.; Linnemann A. R.; Hounhouigan J. D.; Nout M. J. R.; Van Boekel M. A. J. S. Baobab Food Products: A Review on their Composition and Nutritional Value. Critical Reviews in Food Science and Nutrition 2009, 49, 254-274.

Material and methods

Sensory evaluation

Four different samples (traditional and commercial) were presented to the panellists as the following:

- Traditional ambient temperature Vinto juice (3C)
- Traditional boiled Vinto juice (3H)
- Commercial syrup diluted 1:4 (Syrup)
- Commercial instantaneous juice (Instantaneous)

The Bissap samples were evaluated and scored by a trained sensory panel (as described on ISO 11035:1994 Sensory analysis).
The panel was composed by university employees and students (n=7) previously selected according their sensory ability and familiarity with juices.
Sensory attributes were generated during preliminary focus group sessions guided by a panel leader. A total of 20 sensory attributes were developed, with correspondent references/or anchors, with panel consensus, as represented in Table 1.

Table 1 - Bissap "Hibiscus" Drink - Attributes definition.

Bissap " *Hibiscus* " Drink - Attributes definition

ATTRIBUTES	DEFINITION
APPEARANCE	
COLOR INTENSITY	intensity or strength of the color from light to dark (weak to strong)
VISCOSITY	in everyday terms (and for fluids only), viscosity is "thickness". Thus, water is "thin", having a lower viscosity, while honey is "thick", having a higher viscosity.
ODOUR EVALUATION	
ODOUR/SMELL	
FLORAL	general term for a product with aroma or flavor reminiscent of flowers. May be very pleasant.
floral- *Hibiscus* flower	
FRUITY	overall description for a product in which fruitiness is the predominant aroma or flavor.
raspberry	
HERBACEOUS	herbaceous: General term (see also "vegetal") for a product with "green," "grassy" or "hay-like" aroma or flavor.
hay	green: the aromatic associated with unprocessed vegetation, such as fruits and grains; this term is related to raw, but has the additional character of hay, weeds, leaves, and grass.
OTHERS	
cold black tea	aroma associated with tea of poor taste which indicates old tea or tea that is not fresh.
raisins	aromatic associated with a grape of any of several varieties that has been dried in the sun or by artificial heat.
honey	aroma or flavor associated with a sweet viscid material elaborated out of the nectar of flowers in the honey sac of various bees.
TASTE EVALUATION	
TEXTURE IN MOUTH	
viscosity	in everyday terms (and for fluids only), viscosity is "thickness". Thus, water is "thin", having a lower viscosity, while honey is "thick", having a higher viscosity.
FLAVOUR	
acid	the taste stimulated by acids, such as citric, malic, phosphoric, etc.
sweet	the taste stimulated by sucrose and other sugars, such as fructose, glucose, etc.
bitter	the taste stimulated by substances such as quinine, caffeine, and hop bitters.
TASTE	
FLORAL	general term for a product with aroma or flavor reminiscent of flowers. May be very pleasant.
floral- *Hibiscus* flower	
FRUITY	overall description for a product in which fruitiness is the predominant aroma or flavor.
raspberry sour cherry	
HERBACEOUS	herbaceous: General term (see also "vegetal") for a product with "green," "grassy" or "hay-like" aroma or flavor.
hay	green: the aromatic associated with unprocessed vegetation, such as fruits and grains; this term is related to raw, but has the additional character of hay, weeds, leaves, and grass.
TASTE EVALUATION	
OTHERS	
cold black tea	aroma associated with tea of poor taste which indicates old tea or tea that is not fresh.
raisins	aromatic associated with a grape of any of several varieties that has been dried in the sun or by artificial heat.
honey	aroma or flavor associated with a sweet viscid material elaborated out of the nectar of flowers in the honey sac of various bees.
OTHERS SENSATIONS	
adstringent	the shrinking or puckering of the tongue surface caused by substances such as tannins.

Consumer Study

Consumers (n=100) were interviewed at two different locations of Porto Catholic University using the central location method: Asprela Campus (n=50) and Foz Campus (n=50).

The samples used for Bissap consumer tasting were the same used for sensory analysis.

Consumers were asked to answer a Check-All-That-Apply (CATA) questionnaire that included 28 sensory and emotional terms (Table 2).

Table 2 - List of attributes considered in CATA question.

SAMPLE				
APPERANCE				
Red Colour				
Pink Colour				
Clarity				
Viscous				
Fluid				
SMELL AND TASTE				
Flowers				
Fruity				
Fresh herb				
Cold Black Tea				
Raisins				
Honey				
Acid				
Sweet				
Bitter				
Sour Cherry				
Hay				
SENSATIONS				
Natural				
Artificial				
Smooth				
Bond				
Rough				
Healthy				
Fresh				
Instantaneous				
Watery				
Strong				
Diluted				
Concentrated				

Data analysis

All statistical analyses were performed using XLSTAT 2012.

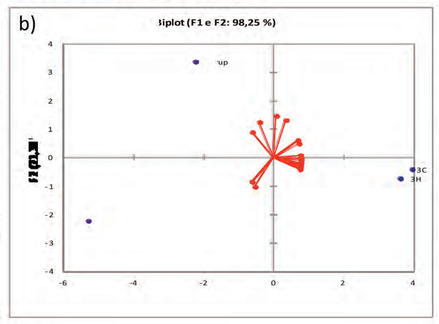
A principal component analysis (PCA) was performed on the correlation matrix of the means of the trained assessors' data.

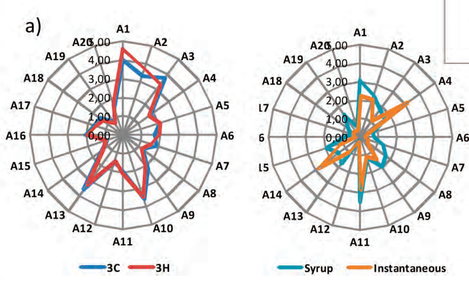
A multiple factor analysis (MFA) was performed on responses to the CATA question in order to identify relationships between the terms and the samples and to get a sensory map of the samples. This analysis was performed on the frequency table that contained responses for each category of terms of the CATA question, considering consumer overall liking scores as supplementary variable. In this analysis, the different categories of terms from the CATA question were considered as separate groups of data to investigate the relationship between them.

Results and discussion

Highly significant differences ($P < 0.001$) between the samples were found for all the evaluated sensory attributes
The first two principal components (PCs) accounted for by 76,95% and 21,30% of the variance of the experimental data, respectively.

- **Samples 3H & 3C** – floral, hay, cold black tea, raisins, bitter, acid and adstringent attributes
- **Syrup** – sweet and sour cherry attributes
- **Instantaneous** – raspberry attribute

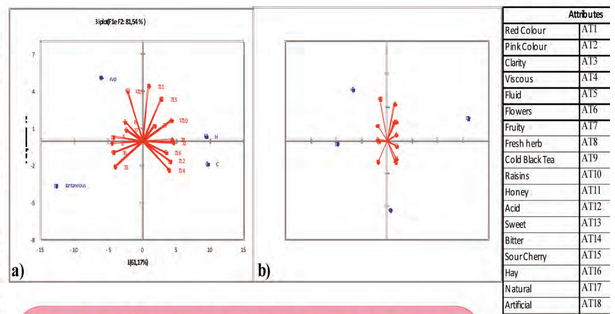




ATTRIBUTES	Number
color intensity	1
viscosity-A	2
floral - *Hibiscus* flower	3
raspberry	4
hay	5
cold black tea	6
raisins	7
honey	8
viscosity-TE	9
acid	10
sweet	11
bitter	12
floral - *Hibiscus* flower	13
raspberry	14
sour cherry	15
hay	16
cold black tea	17
raisins	18
honey	19
adstringent	20

Figure 1 – a) Sensory profiles (QDA) and b) Principal Component Analysis of Bissap samples

- A multiple factor analysis (MFA) was performed on responses to the CATA question in order to identify relationships between the terms and the samples and to get a sensory map of the samples.
- Sample 3H - red colour, viscous, cold black tea and raisins sensory attributes; concentrated and bond emotional terms.
- Sample 3C – acid, bitter and hay sensory attributes; rough and strong emotional terms.
- Syrup – sweet, fruity and fresh herb sensory attributes; natural and smooth emotional terms.
- Instantaneous – pink colour, clarity and floral sensory attributes; fresh, instantaneous, diluted and watery emotional attributes.



	Attributes
Red Colour	AT1
Pink Colour	AT2
Clarity	AT3
Viscous	AT4
Fluid	AT5
Flowers	AT6
Fruity	AT7
Fresh herb	AT8
Cold Black Tea	AT9
Raisins	AT10
Honey	AT11
Acid	AT12
Sweet	AT13
Bitter	AT14
Sour Cherry	AT15
Hay	AT16
Natural	AT17
Artificial	AT18
Smooth	AT19
Bond	AT20
Rough	AT21
Healthy	AT22
Fresh	AT23
Instantaneous	AT24
Watery	AT25
Strong	AT26
Diluted	AT27
Concentrated	AT28

Figure 2 - Multiple Factor Analysis on the Check-All-That-Apply questions a) representation of the attributes for sensory characteristics category and b) representation of the attributes for emotional associations category.

- The sensory profile obtained reveals that samples produced from calices are represented by hay, Hibiscus flower and cold black tea descriptors, the syrup by sweet and instantaneous juice by raspberry, attributes.
- Consumers acceptability in terms of global appearance are divided into two groups, the first one with syrup and instantaneous juice samples and the second one with samples obtained by calices, in a decrease order of acceptability (according Tuckey's test).
- Highly significant differences were found in the frequencies in which CATA terms were used for describing the four samples, suggesting that this methodology was able to detect differences in consumer perception of the drinks. Sample configuration from consumers' CATA counts and trained assessors data were similar, suggesting a good agreement between both evaluations.
- Considering results from the present study, the use of CATA questions could be an interesting and simple methodology to get an insight on consumer perception of a food product. Using this methodology, a map of the samples could be generated taking only consumer perception of the products.

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SEVENTH FRAMEWORK PROGRAMME